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(72) Inventor: Wilfred Henry Wilkinson

(19)

(54) A STATOR BLADE FOR A GAS TURBINE ENGINE

(71) We, ROLLS-ROYCE LIMITED, a British Company of 65 Buckingham Gate, London, SW1E 6AT, formerly ROLLS-ROYCE (1971) LIMITED, a British Company of Norfolk House, St. James's Square, London, SW1Y 4 JR, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to a stator blade for a gas turbine engine.

Throughout this specification the term 'stator blade' is to be understood to include within its scope outlet guide vanes, nozzle guide vanes and aerodynamic struts.

Stator blades such as nozzle guide vanes which are located in the hottest parts of the engines have had to withstand more and more arduous conditions as the temperature of the combustion in the engine has increased, and this has recently led to a situation in which the platforms or shrouds of these vanes have caused major difficulties. Thus the platforms which carry various loads from the aerofoil portions of the stators have of nessity been of considerable thickness and consequently difficult to cool.

The present invention provides a construction for a stator blade which enables the platforms to be relatively thin and consequently relatively easily cooled.

According to the present invention a stator blade for a gas turbine engine comprises an aerofoil portion and inner and outer platforms, the aerofoil portion extending through the platforms to form projections, and mounting members extending from one said projection and being adapted to engage with supporting structure so that in operation, loads are transmitted directly from the aerofoil portion through the projection and the mounting member to the supporting structure, the mounting members comprising a pair of dogs extending from the parts of the projection corresponding with opposed flanks of the aerofoil portion. These dogs may be joined by a web which extends into and forms a division across the hollow interior of the aerofoil portion.

The mounting members may engate directly with the supporting structure.

The invention will now be particularly described, merely by way of example, with reference to the accompanying drawings in which:-

Fig. 1 is a view of a gas turbine engine which incorporates a stator blade in accordance with the invention.

Fig. 2 is a sectional view through the nozzle guide vane assembly of the engine of Fig. 1, and

Fig. 3 is a perspective view of the outer shroud of the guide vanes of Fig. 2.

In Fig. 1 there is shown a gas turbine engine 10 comprising a compressor section 11, combustion section 12, turbine section 13 and final nozzle 14. The casing of the engine is shown broken away at the downstream end of the combustion section 12 to expose to view the downstream end of the combustion chamber 15, the nozzle guide vanes 16 and the turbine rotor 17.

The combustion section components are more easily visible in the enlarged section of Fig. 2. It will be seen that the downstream extremity of the combustion chamber 15 is provided with inner and outer flanges 17 and 18 which seal by way of sealing wires 19 and 20 respectively against forward sealing flanges 21 and 22 which extend from the inner and outer platforms or shrouds 23 and 24 of the nozzle guides vanes 16. The platforms 23 and 24 are also provided with rearward sealing flanges 25 and 26; in the case of the inner flange 25 sealing is effected against a resilient sealing member 27 by way of a further sealing wire 28, while in the case of the outer flange 26 an annular spring member 29 is provided to seal against the flange and fixed structure of the engine at 30.

In order to mount each vane 16 and to support it against aerodynamic loads the aerofoil portion 31 is extended inwardly and outwardly past the inner and outer platforms 23 and 24 respectively to produce aerofoil shaped projections 32 and 33. The projections 33 and associated structure are best seen from Fig. 3. Extending from the projections 32 and 33 are integrally formed mounting members

comprising two dogs of which 34 and 35, which extend from the projection 33 are visible in Fig. 3 while two further dogs extend from the projection 32, only the dog 36 being visible in Fig. 2.

The dogs 34 and 35 can be seen from Fig. 3 to be buttressed one against the other by a pair of angled buttresses, of which only one is visible at 37 in Fig. 3, which in turn act on a web 38 which extends between the hollow flanks of the aerofoil portion 31 of the vane 16. It will be understood that a similar arrangement obtains for the inner shroud.

Each of the dogs is provided with a cut-away portion to allow engagement with supporting structure of the engine. Thus the cut-away portion 39 in the dog 35 is visible in Fig. 3 and enables the dog to engage with a projection 40 which forms part of a supporting ring 41 which is connected to the supporting structure of the engine.

In a similar manner the inner dogs engage with projections from a supporting member 42 which in this case itself forms part of the supporting structure of the engine.

It will thus be seen that aerofoil loads in the circumferential and axial directions are taken from the aerofoil portion 31 through the platforms 23 and 24 directly into the projections 32 and 33 and thus directly to the dogs and to the supporting structure of the engine. The platforms 23 and 24 are only called upon to withstand relatively small loads such as those due to the pressure differences across them.

In this embodiment the vanes have been described as separate members, however it will be understood that it would be possible to produce the vanes in multiples such as pairs or triples, or to join single vanes metallurgically to produce a multiple.

It will be noted that in the present invention the mounting of the aerofoil protion of the guide vane and its support against aerodynamic forces is completely separated from the function of sealing the forward and rearward extremities of the guide vane against adjacent structure; thus in the above embodiment forward and rearward sealing flanges are provided which are completely separate from the guide vane mounting structure. Therefore it is possible to take advantage of the fact that the mounting structure need not be a massive complete flange but can be a number of separate dogs which are directly connected to the aerofoil portion, from which the forces are transmitted; the sealing flanges in this case need not possess considerable intrinsic strength but can be relatively light and of relatively thin section. This reduction in thickness of the platforms and associated flanges reduces considerably the difficulty experienced in providing cooling for this area.

It will be understood that a number of modifications could be made to the embodiments described above. Thus it will be appreciated that it will be possible to use this form of construction for any stator of a gas turbine engine, and while the advantages might not be as considerable in a situation where cooling was not necessary, the construction would be equally suitable.

In addition to the above it will be seen that owing to the provision of sealing arrangements at the forward and rearward extremities of the platforms, the mounting arrangement is effected in an area of the engine in which the temperature is substantially independent of that of the gas flow. This arrangement is claimed in our co-pending application no. 1605310 23546/75 and provides considerable advantage in the mounting of the vane.

WHAT WE CLAIM IS:

1. A stator vane for a gas turbine engine comprising an aerofoil portion and inner and outer platforms, the aerofoil portion extending through the platforms to form projections, and mounting members extending from one said projection and being adapted to engage with supporting structure so that, in operation, loads are transmitted directly from the aerofoil portion through the projection and the mounting member to the supporting structure, the mounting members comprising a pair of dogs extending from those parts of the projection corresponding with the opposed flanks of the aerofoil portion.

2. A stator vane as claimed in claim 1 and in which each said dog comprises a cut-away portion adapted to engage with a projection from said supporting structure.

3. A stator vane as claimed in claim 1 or claim 2 and in which said aerofoil portion is hollow and said dogs are joined by a web which extends into and forms a division across the hollow interior of the aerofoil portion.

4. A stator vane as claimed in any of claims 1 to 3 and in which said supporting structure comprises a ring having projections therefrom, each said projection being adapted to engage with one said dog.

5. A stator vane as claimed in any of claims 1 to 4 and in which two said dogs extend from the projection of the aerofoil portion through the inner platform and two said dogs extend from the projection of the aerofoil portion through the outer platform.

6. A stator vane as claimed in any preceding claim and in which said aerofoil portion is associated with its own separate inner and outer platforms.

7. A stator vane as claimed in any of claims 1 to 5 and in which a plurality of said aerofoil portion are associated with a single outer and a single inner platform.

8. A stator vane for a gas turbine engine substantially as hereinbefore particularly described with reference to the accompanying drawings.

9. A gas turbine engine having a stator vane as claimed in any preceding claim.

J.C. PURCELL
Chartered Patent Agent and
Agent for the Applicants

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG. 1.

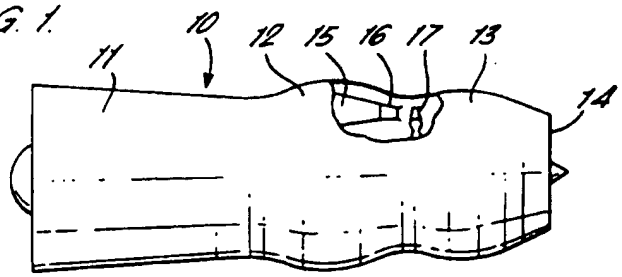
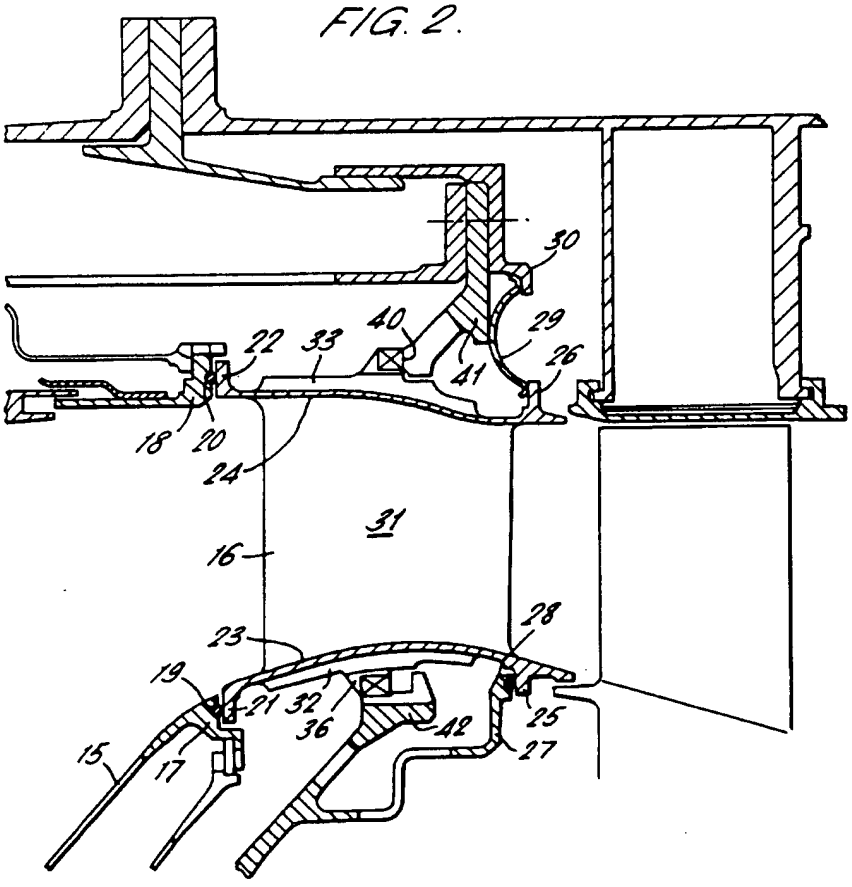


FIG. 2.



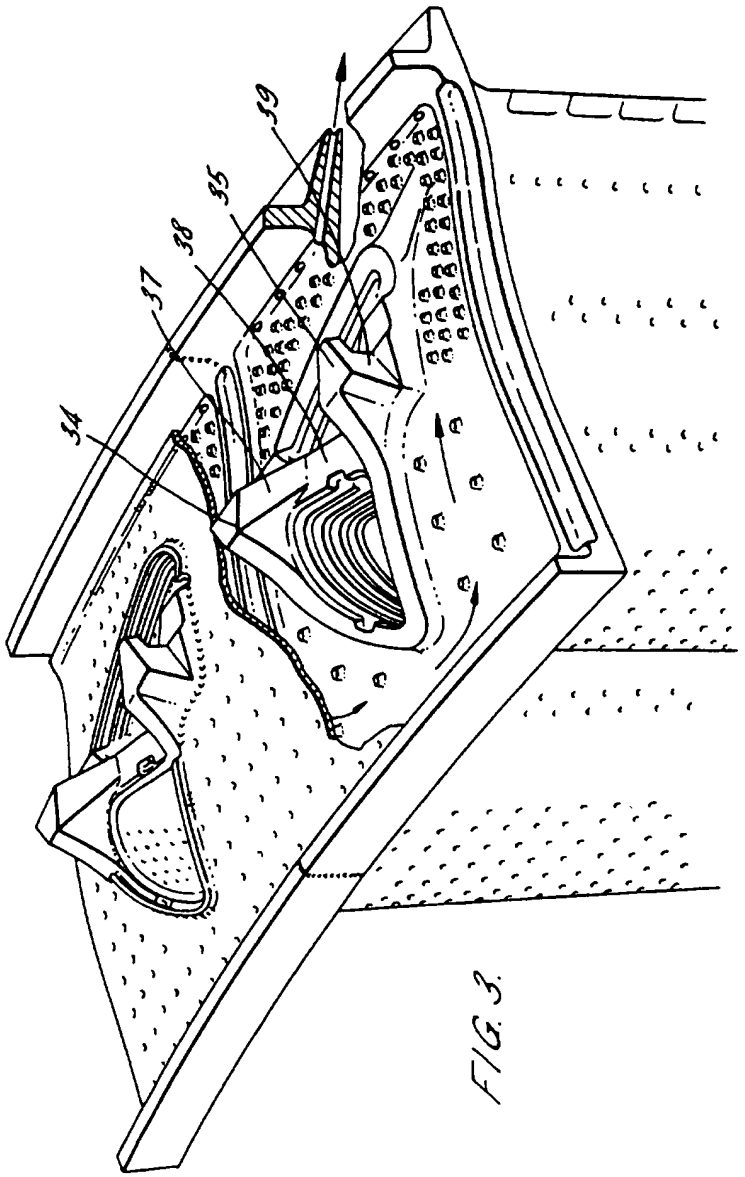


FIG. 3.